

REMARKS

The Applicants thank the Examiner for the careful examination of this application and respectfully request the entry of the amendments indicated hereinabove.

Claims 1-20 are pending. Of the pending claim set, Claims 1-10 and 19-20 are rejected and Claims 11-18 are withdrawn from consideration. Claims 1 and 10 are amended hereinabove.

Independent Claim 1 positively recites depositing a layer of insulating material in contact with a total exposed surface of the lightly-doped extension regions. Claim 1 also positively recites forming an interfacial layer of nitrogen below the layer of insulating material and within the total exposed surface of the lightly-doped extension regions. These advantageously claimed features are not taught or suggested by the patent granted to Ahmad or the patent publications of Wieczorek et al. and Chen et al.

Ahmad does not teach the advantageously claimed invention because Ahmad does not teach depositing a layer of insulating material in contact with a total exposed surface of the lightly-doped extension regions (column 4 lines 16-20 and 43-56; note that the oxide layer 130 is grown and not deposited). In addition,

Wieczorek et al. does not teach the advantageously claimed invention because Wieczorek et al. does not teach depositing a layer of insulating material in contact with a total exposed surface of the lightly-doped extension regions (FIGS. 1a and 2c; paragraphs 0012, 0039). Furthermore, Chen et al. does not teach the advantageously claimed invention because Chen et al. does not teach depositing a layer of insulating material in contact with a total exposed surface of the lightly-doped extension regions (FIGS. 3-5 and 7; paragraphs 0034, 0062).

Because neither Ahmad, Wieczorek et al. nor Chen et al. teach the step of depositing a layer of insulating material in contact with a total exposed surface of the lightly-doped extension regions; the combination of Ahmad, Wieczorek et al. and Chen et al. also does not teach the advantageously claimed step of depositing a layer of insulating material in contact with a total exposed surface of the lightly-doped extension regions.

The Applicants traverse the assertion (on page 3 of the Office Action) that FIG. 2 of Ahmad teaches the advantageously claimed lightly doped extension regions. The Applicants submit that Ahmad states in column 3 lines 37-38 that the lightly doped extension regions are “not shown in the Figures” (also, note that element 118 of FIG. 2 is the nitrogen implant area – column 3 lines 48-67 through column 4 lines 1-3).

The Applicants also traverse the assertion (on page 4 of the Office Action) that "Col. 1 line 66 to Col. 2 line 11 and/or Col. 2 lines 44-64" of Ahmad teach the advantageously claimed interfacial layer of nitrogen. The Applicants submit that in column 1 lines 66 through column 2 line 11 that Ahmad teaches "nitrogen implantation into the source/drain regions" (not nitrogen implantation into the total exposed surface of the lightly-doped extension regions), while in column 2 lines 44-61 Ahmad teaches "forming silicon nitride under the gate edges" (not forming an interfacial layer of nitrogen within the total exposed surface of the lightly-doped extension regions).

Furthermore, the Applicants traverse the assertion (on page 5 of the Office Action) that Chen teaches the advantageously claimed step of removing all of the capping layer after annealing. The Applicants submit that Chen teaches the removal of only a portion of the capping layer (paragraph 0058).

Moreover, the Applicants traverse the assertion (on page 5 of the Office Action) that "It would have been within the scope of one of ordinary skill in the art at the time of the invention to combine the teachings of Ahmad and Chen". The Applicants submit that Ahmad teaches a method where the cap layer is not removed (rather, it is left in place "to block out diffusion from the BPSG to be deposited") and the cap layer is covered by BPSG (column 5 lines 44-50). Therefore, one of ordinary skill in the art would not combine a method requiring

the cap layer to remain (Ahmad) with a method requiring the removal of portions of the cap layer (Chen).

Regarding Claim 4, the Applicants traverse the assertion (on page 7 of the Office Action) that in column 4 lines 8-15 Ahmad teaches the advantageously claimed interfacial nitride layer having an atomic nitrogen concentration in the range of 2-15 atomic percent. The Applicants submit that in column 4 line 13 Ahmad teaches nitrogen concentration in the range of 1×10^{12} atoms to 1×10^{13} atoms. Therefore, Ahmad teaches a concentration of less than 0.5 atomic percent – a concentration range that is grossly insufficient for reducing the junction depth of the extensions during the high temperature anneal by retarding boron lateral diffusion (without degrading the active dopant concentration – for lower parasitic resistance; see paragraphs 0019-0020 of the Specification).

Regarding Claim 19, the Applicants traverse the assertion (on page 15 of the Office Action) that if “the prior art does not teach “breaking vacuum” thus the process is understood to be performed”. The Applicants submit that the absence of a teaching does not create the teaching. The Applicants also submit that one of ordinary skill in the art would not read a limitation, such as the claimed limitation of performing two steps without breaking vacuum, without express instruction because any loss of flexibility in the manufacturing process flow may increase the time and

cost of device fabrication. Lastly, the Applicants submit that the critical result achieved by the limitations of Claim 19 is discussed in paragraph 0023.

Due to the foregoing reasons, the Applicants respectfully traverse the Examiner's rejection of Claim 1 and respectfully assert that Claim 1 is patentable over the patent granted to Ahmad or the patent publications of Wieczorek et al. and Chen et al.; either alone or in combination. Furthermore, Claims 2-9 and 19 are allowable for depending on allowable independent Claim 1 and, in combination, including limitations not taught or described in the references of record.

Independent Claim 10 positively recites depositing a layer of silicon oxide in contact with a total exposed surface of the lightly-doped extension regions. Claim 10 also positively recites forming an interfacial layer of nitrogen below the layer of silicon oxide and within the total exposed surface of the lightly-doped extension regions. These advantageously claimed features are not taught or suggested by the patent granted to Ahmad or the patent publications of Wieczorek et al. and Chen et al.

Ahmad does not teach the advantageously claimed invention because Ahmad does not teach depositing a layer of silicon oxide in contact with a total exposed surface of the lightly-doped extension regions (column 4 lines 16-20 and 43-56; note that the oxide layer 130 is grown and not deposited). In addition,

Wieczorek et al. does not teach the advantageously claimed invention because Wieczorek et al. does not teach depositing a layer of silicon oxide in contact with a total exposed surface of the lightly-doped extension regions (FIGS. 1a and 2c; paragraphs 0012, 0039). Furthermore, Chen et al. does not teach the advantageously claimed invention because Chen et al. does not teach depositing a layer of silicon oxide in contact with a total exposed surface of the lightly-doped extension regions (FIGS. 3-5 and 7; paragraphs 0034, 0062).

Because neither Ahmad, Wieczorek et al. nor Chen et al. teach the step of depositing a layer of silicon oxide in contact with a total exposed surface of the lightly-doped extension regions; the combination of Ahmad, Wieczorek et al. and Chen et al. also does not teach the advantageously claimed step of depositing a layer of silicon oxide in contact with a total exposed surface of the lightly-doped extension regions.

The Applicants traverse the assertion (on page 10 of the Office Action) that FIG. 2 of Ahmad teaches the advantageously claimed lightly doped extension regions. The Applicants submit that Ahmad states in column 3 lines 37-38 that the lightly doped extension regions are "not shown in the Figures" (also, note that element 118 of FIG. 2 is the nitrogen implant area – column 3 lines 48-67 through column 4 lines 1-3).

The Applicants also traverse the assertion (on page 11 of the Office Action) that “Col. 1 line 66 to Col. 2 line 11 and/or Col. 2 lines 44-64” of Ahmad teach the advantageously claimed interfacial layer of nitrogen. The Applicants submit that in column 1 lines 66 through column 2 line 11 that Ahmad teaches “nitrogen implantation into the source/drain regions” (not nitrogen implantation into the total exposed surface of the lightly-doped extension regions), while in column 2 lines 44-61 Ahmad teaches “forming silicon nitride under the gate edges” (not forming an interfacial layer of nitrogen within the total exposed surface of the lightly-doped extension regions).

Furthermore, the Applicants traverse the assertion (on page 12 of the Office Action) that Chen teaches the advantageously claimed step of removing all of the capping layer after annealing. The Applicants submit that Chen teaches the removal of only a portion of the capping layer (paragraph 0058).

Moreover, the Applicants traverse the assertion (on page 12 of the Office Action) that “It would have been within the scope of one of ordinary skill in the art at the time of the invention to combine the teachings of Ahmad and Chen”. The Applicants submit that Ahmad teaches a method where the cap layer is not removed (rather, it is left in place “to block out diffusion from the BPSG to be deposited”) and the cap layer is covered by BPSG (column 5 lines 44-50). Therefore, one of ordinary skill in the art would not combine a method requiring

the cap layer to remain (Ahmad) with a method requiring the removal of portions of the cap layer (Chen).

Regarding Claim 4, the Applicants traverse the assertion (on page 12 of the Office Action) that in column 4 lines 8-15 Ahmad teaches the advantageously claimed interfacial nitride layer having an atomic nitrogen concentration in the range of 2-15 atomic percent. The Applicants submit that in column 4 line 13 Ahmad teaches nitrogen concentration in the range of 1×10^{12} atoms to 1×10^{13} atoms. Therefore, Ahmad teaches a concentration of less than 0.5 atomic percent – a concentration range that is grossly insufficient for reducing the junction depth of the extensions during the high temperature anneal by retarding boron lateral diffusion (without degrading the active dopant concentration – for lower parasitic resistance; see paragraphs 0019-0020 of the Specification).

Regarding Claim 20, the Applicants traverse the assertion (on page 15 of the Office Action) that if “the prior art does not teach “breaking vacuum” thus the process is understood to be performed”. The Applicants submit that the absence of a teaching does not create the teaching. The Applicants also submit that one of ordinary skill in the art would not read a limitation, such as the claimed limitation of performing two steps without breaking vacuum, without express instruction because any loss of flexibility in the manufacturing process flow may increase the time and

cost of device fabrication. Lastly, the Applicants submit that the critical result achieved by the limitations of Claim 20 is discussed in paragraph 0023.

Due to the foregoing reasons, the Applicants respectfully traverse the Examiner's rejection of Claim 10 and respectfully assert that Claim 10 is patentable over the patent granted to Ahmad or the patent publications of Wieczorek et al. and Chen et al.; either alone or in combination. Furthermore, Claim 20 is allowable for depending on allowable independent Claim 10 and, in combination, including limitations not taught or described in the references of record.

For the reasons stated above, this application is believed to be in condition for allowance. Reexamination and reconsideration is requested.

Respectfully submitted,

/Rose Alyssa Keagy/

Rose Alyssa Keagy
Attorney for Applicants
Reg. No. 35,095

Texas Instruments Incorporated
P.O. BOX 655474, M/S 3999
Dallas, TX 75265
Telephone: 972/917-4167
FAX: 972/917-4409/4418